ALLUVIAL VALLEY FLOOR DECISION DOCUMENT

For Portions of Stocker and East Fork Armells Creeks
in the Vicinity of Western Energy's Rosebud Mine

Prepared by
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STOCKER CREEK

In June 1982, the Department of State Lands (DSL) made a negative alluvial valley floor (AVF) decision on a portion of Stocker Creek from its headwaters in Section 1, T1N, R39E to the corner of sections 23, 24, 25 and 26 (T2N, R40E). In this decision, DSL indicated that although this drainage met the geologic criterion of an AVF, it did not meet the agricultural criteria.

The portion of Stocker Creek from its crossing of the section corners to its confluence with East Fork Armells Creek (EFAC) is considered in this decision document.

The Department of State Lands has determined that Stocker Creek, from the corner of sections 23, 24, 25 and 26 (T2N, R40E) to its confluence with EFAC meets the geologic criteria, but does not meet the agricultural criteria of an alluvial valley floor as described in Montana's Strip and Underground Mine Reclamation Rules and Regulations 26.4.325(2)(b)(ii). Therefore this portion of Stocker Creek is not an alluvial valley floor. The Rules and Regulations state that the Department shall determine that an AVF exists if it finds that:

1. Unconsolidated streamlaid deposits holding streams are present; and

2. there is sufficient water to support agricultural activities as evidenced by:

   A. The existence of flood irrigation in the area in question or its historical use;

   B. the capability of an area to be flood irrigated, based on stream-flow water yield, soils, water quality, and topography; or

   C. subirrigation of the lands in question derived from the groundwater system of the valley floor.

DSL's findings regarding each of these criteria are further explained below.

The Department has made its decision based on:

1. Literature review.

2. Field data submitted by Hydrometrics for Western Energy.

3. Analysis of color infrared aerial photography.

4. On-site investigation by DSL staff.

1. Unconsolidated Streamlaid Deposits

The extent of alluvial, or unconsolidated streamlaid deposits in Stocker Creek was identified by Hydrometrics for Western Energy based on geomorphic criteria. Mapping of alluvium was accomplished using color infrared aerial photographs and field reconnaissance, with three alluvial well cross-sections as supporting data.

The general stratigraphy of alluvial materials is that of up to about 20 feet of fine-grained alluvial sand and silt overlying 5 to 20 feet of gravel and sand (Hydrometrics 1983). Delineation of the outer edge of the alluvium was based on geomorphic criteria observed on air photos and field investigations. Due to the limited amount of drill hole data, mapped alluvial-bedrock and alluvial-colluvial contacts are not precise, however, the delineations were felt to be of sufficient accuracy for this determination. The alluvium-bedrock boundary is assumed to follow the outer extent of terrace surfaces except where colluvial deposits are shown overlapping the terraces.

2. Sufficient Water to Support Agricultural Activities

A. The existence of flood irrigation in the area in question or its historical use.

There is presently no flood irrigation along this portion of Stocker Creek. The USGS (Federal 1981) estimates that there are no irrigated acres in the 155 square miles of the East Fork Armells Creek basin which includes Stocker Creek.

Comparing maps of alluvial aquifer and terrace levels with agricultural fields and land uses, Fields 75 through 81 lay outside of the alluvium with the exception of a portion of Field 78 (Hydrometrics 1983). Approximately 5 acres of Field 78 is situated on an upper alluvial terrace level. Currently no flood irrigation ditch services these Fields. None of the Fields showed production substantially greater than dryland yields. The Fields produced 30 bushels per acre compared to the non-irrigated average of 26 bushels per acre for Rosebud County (Montana Department of Agriculture 1983). None of the Fields will be directly affected by Area A Extension mining.

In summary, flood irrigation is not actively conducted along this portion of Stocker Creek at the present time.

B. The capability of an area to be flood irrigated based on stream-flow water yield, soils, water quality and topography.

There are no significant water quality constraints for use of Stocker Creek flow for irrigation purposes. Irrigation is limited by the ephemeral nature of discharge and the small quantity of water available during the irrigation season (Hydrometrics 1983). Winter wheat production is on a dryland basis.

C. Subirrigation of the lands in question, derived from the groundwater system of the valley floor.

Subirrigated areas were delineated based on existing vegetation types, evaluation of CIR aerial photographs and water level data available from alluvial wells. Review of CIR photographs for October 1980, September 1982 and 1983 by DSL staff showed no evidence of vegetation enhancement due to flood irrigation or subirrigation except in the incised stream channel and portions of the lower alluvial terrace.

Comparing maps of agricultural activities and subirrigation delineation, Fields 75 through 81 are not affected by subirrigation (Hydrometrics 1983). The land identified as subirrigated is considered undeveloped rangeland since it is not managed or controlled and is considered of limited agricultural use.

Therefore, because of the lack of agriculturally important subirrigation evidenced by this review, DSL does not believe that this portion of Stocker Creek meets the subirrigation criteria of an AVF.

In conclusion, Stocker Creek from its crossing of the corner of sections 23, 24, 25 and 26 (T2N, R40E) to its confluence with East Fork Armells Creek is not an alluvial valley floor. Although it meets the geologic criterion, it fails to meet the agricultural criteria as there is insufficient water for flood irrigation, and subirrigation is confined mainly to the incised portion of the stream channel.

EAST FORK ARMELLS CREEK

In December 1981, the Department of State Lands (DSL) made a negative alluvial valley floor (AVF) decision on a portion of East Fork Armells Creek (EFAC) from its crossing of Highway 39 near Colstrip (section 3, T1N, R41E) to the western extent of Area C (section 17, T1N, R40E). In this decision, DSL indicated that although this drainage met the geologic criteria of an AVF, it did not meet the agricultural criteria.

The portion of East Fork Armells Creek from its crossing of Highway 39 near Colstrip (section 3, T1N, R41E) north to the confluence with Corral Creek (section 28, T3N, R41E) is considered in this decision document.

The Department of State Lands has determined that the portion of EFAC from the crossing of Highway 39 (section 3, T1N, R41E) north to the confluence of Stocker Creek (section 16, T2N, R41E) meets the geologic criteria, but does not meet the agricultural criteria of an alluvial valley floor as described in Montana's Strip and Underground Mine Reclamation Rules and Regulations 26.4.325(2)(b)(ii). Therefore this portion of EFAC is not an alluvial valley floor. The Department also determined that the portion of EFAC from the confluence of Stocker Creek (section 16, T2N, R41E) north to the confluence of Corral Creek (section 28, T3N, R41E) does meet the geologic and agricultural criteria and therefore is an alluvial valley floor. The Rules and Regulations state that the Department shall determine that an AVF exists if it finds that:

1. Unconsolidated streamlaid deposits holding streams are present; and

2. there is sufficient water to support agricultural activities as evidenced by:

   A. The existence of flood irrigation in the area in question or its historical use;

   B. the capability of an area to be flood irrigated, based on stream-flow water yield, soils, water quality, and topography; or

   C. subirrigation of the lands in question derived from the groundwater system of the valley floor.

DSL's findings regarding these criteria are discussed separately for each portion of EFAC.

The Department has made its decision based on:

1. Literature review.

2. Information submitted by Hydrometrics for Western Energy.

3. Analysis of color infrared photography.

4. On-site investigation by DSL staff.

1. Unconsolidated Streamlaid Deposits

The extent of alluvial or unconsolidated streamlaid deposits along this portion of EFAC was identified by Hydrometrics for Western Energy based on geomorphic criteria. Mapping of the alluvium was accomplished using color infrared aerial stereophotographs supplemented by field reconnaissance and exploratory drilling.

The general stratigraphy of alluvial materials is 15 to 20 feet of fine grained colluvial, aeolian and alluvial materials overlying 1 to 15 feet of gravel (Hydrometrics 1982). Delineation of the outer boundary of the alluvium was based on geomorphic criteria and drill hole data. Where subsurface data were not available, the mapped alluvial/bedrock boundary was estimated from field reconnaissance and aerial photographs. The delineation of the alluvial boundary therefore may not be precise, however, the delineations were considered sufficiently accurate for this determination. The alluvium/bedrock boundary closely followed the outer extent of the terrace surfaces, except where colluvium may have been deposited over the alluvial/bedrock contact.

2. Sufficient Water to Support Agricultural Activities

A. The existence of flood irrigation in the area in question or its historical use.

Flood irrigation is currently not conducted along this portion of EFAC and no surface irrigation structures are visible. Historical land use data are limited and the current land use is undeveloped rangeland.

B. The capability of an area to be flood irrigated based on stream-flow water yield, soils, water quality and topography.

Existing irrigation practices along EFAC and in the general Colstrip area indicate that development of new irrigation systems on streams similar in size and runoff characteristics is not occurring primarily due to insufficient quantity of irrigation water. Landowners in the vicinity of Colstrip generally feel that sufficient water for irrigation may be present about once every three years and apparently that variability is not sufficient to encourage construction or maintenance of flood irrigation structures (Hydrometrics 1984).

Irrigation potential may also be limited by existing structures and land use practices along this portion of EFAC. Cost of installing ditches beneath the railroad or highway would be very high. Road crossing and industrial and municipal development may limit the area that could be developed for irrigation.

Water quality of this portion of EFAC may be of good quality, particularly if derived from storm runoff and snowmelt. Water for irrigation other than that available during runoff events probably would be of marginal or unacceptable quality for long-term irrigation (Hydrometrics 1982). Use of reservoirs as a source of irrigation water during any time other than peak runoff is not recommended by SCS personnel due to salinity problems that would result.

In summary, this portion of EFAC does not appear to have irrigation water available in sufficient quantity and quality to irrigate cropped acreage with certainty each year.

C. Subirrigation of the lands in question derived from the groundwater system of the valley floor.

Subirrigated areas were delineated based on water levels in alluvial wells, specific plant use information and color infrared aerial photography. Review of CIR photographs for June 1973 by DSL staff showed areas of bright red, indicating actively photosynthesizing vegetation, continuously along the stream channel, lower and middle alluvial terraces, and portions of the upper terrace. Review of photographs for June 1976 (a very dry summer) which were taken after the installation of the surge pond showed areas of subirrigation confined to the stream channel and lower alluvial terrace. No additional enhancement of vegetation was noted. Based on these two sets of photographs it would appear that the installation of the surge pond had minimal affect on the amount of subirrigation.

Review of photographs for September 1982 and 1983 showed no evidence of vegetation enhancement due to flood irrigation or subirrigation except in the incised stream channel and portions of the lower alluvial terrace. The land identified as subirrigated is considered undeveloped rangeland since it is not managed or controlled and is considered of limited agricultural use.

Therefore, because of the lack of agriculturally important subirrigation evidenced by this review, DSL does not believe that this portion of EFAC meets the subirrigation criteria of an AVF.

In conclusion, EFAC from its crossing of Highway 39 near Colstrip (section 3, T1N, R41E) to the confluence of Stocker Creek (section 16, T2N, R41E) does not meet the requirements of an alluvial valley floor. Although it meets the geologic criterion, it fails to meet the agricultural criteria as there is insufficient water for flood irrigation and subirrigation is confined mainly to the stream channel and portions of the lower alluvial terrace.

AVF Portion of EFAC

1. Unconsolidated Streamlaid Deposits

Mapping of alluvium was accomplished using color infrared aerial photographs supplemented by field reconnaissance. Delineation of the outer edge of the alluvium was based on geomorphic criteria observed on air photos and field inventigations. The mapped alluvial-bedrock and alluvial-colluvial contacts are not precise, however, the delineations were felt to be of sufficient accuracy for this determination. The alluvium-bedrock boundary is assumed to follow the outer extent of terrace surfaces except where colluvial deposits are shown overlapping the terraces.

The general stratigraphy of alluvial materials along this portion of EFAC consists of 15 to 20 feet of fine-grained colluvial and alluvial material overlying a few to as much as 20 feet of gravel or sandy gravel (Hydrometrics 1983). This stratigraphy is similar to alluvium upstream from Colstrip where considerably more lithologic data are available (Hydrometrics 1982).

2. Sufficient Water to Support Agricultural Activities

A. The existence of flood irrigation in the area in question or its historical use.

Approximately 15 acres of Toppy Lee's Field 52 on the lower terrace of EFAC is reported to be naturally flood irrigated during some years. Natural flooding occurs during periods of high runoff from spring storms or snowmelt.

Approximately 46 acres in Corral Creek near its confluence with EFAC is irrigated with a contour spreader dike system during the spring and occasional high summer flow on Corral Creek.

Jim Snider, a farmer along EFAC, noted that in the early 1900's an extensive water development system, including ditches and dikes, was constructed along this portion of the creek. He does not know if the development ever provided irrigation water. No irrigation structures were observed by Hydrometrics during the 1983 field reconnaissance.

B. The capability of an area to be flood irrigated based on stream-flow water yields, soils, water quality and topography.

Similar conditions for potential flood irrigation exist along this portion of EFAC as were described for the previous non-AVF segment. It appears that irrigation water is not available in sufficient quantity to irrigate cropped acreage with certainty each year.

C. Subirrigation of the lands in question, derived from the groundwater system of the valley floor.

Subirrigated areas were delineated based on existing vegetation types, evaluation of CIR aerial photographs and water level data available from alluvial wells. Approximately 200 acres underlain by alluvium were identified as being subirrigated along this portion of EFAC (Hydrometrics 1983).

Agricultural lands underlain by alluvium include approximately 90 acres of dryland grain, 25 acres of subirrigated grain, 20 acres of subirrigated alfalfa hay and 15 acres of naturally flood-irrigated hayland which is also apparently subirrigated. Comparison of the maps of agricultural activities and the delineation of subirrigation indicates that Fields 40, 42, 43 and 44 are subirrigated along with portions of Fields 30, 37, 50 and 52 (Hydrometrics 1983). These fields or portions thereof are situated on the lower alluvial terrace level. Groundwater level is estimated to be 4 to 10 feet below the lower terrace level.

Jim Snider who owns or leases fields adjacent to lower EFAC believes that the lower terrace levels are subirrigated. Although production data for most of his fields were not available for 1983, he noted that both alfalfa and wheat on the lower terrace produced higher yields and remained green longer in the summer than crops on adjacent higher terraces.

Toppy Lee who farms and ranches along this portion of EFAC has one alfalfa/grass meadow (Fields 49, 50 and 52) which produces 1.0 to 1.5 tons per acre. According to Lee it is a very important meadow for his operation as it provides enough hay to winter 150 head of cattle. Previous to 1974, Lee reported that he raised sufficient hay for his cattle but because of decreased production he now purchases about 290 tons of hay per year. Lee stated that water levels and flows have increased in EFAC since 1974, resulting in losses of hay production due to increased salinity and waterlogging of soils.

The alfalfa/grass meadow lies on a terrace approximately 6 feet above the channel of the creek and according to Lee is not subirrigated. He does believe that only those meadows which occur on terraces within 18 to 24 inches of the water level in the stream channel are subirrigated. The Department believes that approximately 35 acres of Fields 50 and 52 do receive some benefit from subirrigation. Dollhopf (1982) noted that alfalfa yield was enhanced when the groundwater and effective capillary rise were within 14 feet of the surface. The groundwater level along the portion of EFAC is estimated to be 4 to 10 feet below the lower alluvial terrace (Hydrometrics 1983).

Production values for Fields 49, 50 and 52 were similar to dryland fields. Alfalfa production averages for Rosebud County showed 3.15 tons per acre for irrigated lands and 1.27 tons per acre for dryland fields (Montana Department of Agriculture 1983). The apparent lack of production in response to subirrigation in these Fields may be partially due to the age of the alfalfa stand. Some of the fields have not been replanted for 15 years.

Review of CIR photographs for September 1982 and 1983 by DSL staff showed extensive areas of probable subirrigation along the stream channel and lower terrace from the confluence of Stocker Creek to just north of Field 43 and portions of Fields 50 and 52. These areas generally coincide with the subirrigated areas delineated by Hydrometrics (1983).

Therefore, based on the presence of agriculturally important subirrigation evidenced by this review, DSL believes that this portion of EFAC does meet the subirrigation requirements to consider it an AVF.

In conclusion, EFAC from the Stocker Creek confluence (section 16, T2N, R41E) to Corral Creek confluence (section 28, T3N, R41E) is an alluvial valley floor due to the presence of unconsolidated streamlaid deposits holding streams and sufficient water to support agricultural activities as evidenced by:

1) The existence of natural flood irrigation in the area and,

2) subirrigation of the lands in question, derived from the groundwater system of the valley floor.

References

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